

The D0 Level 2 muon trigger algorithms

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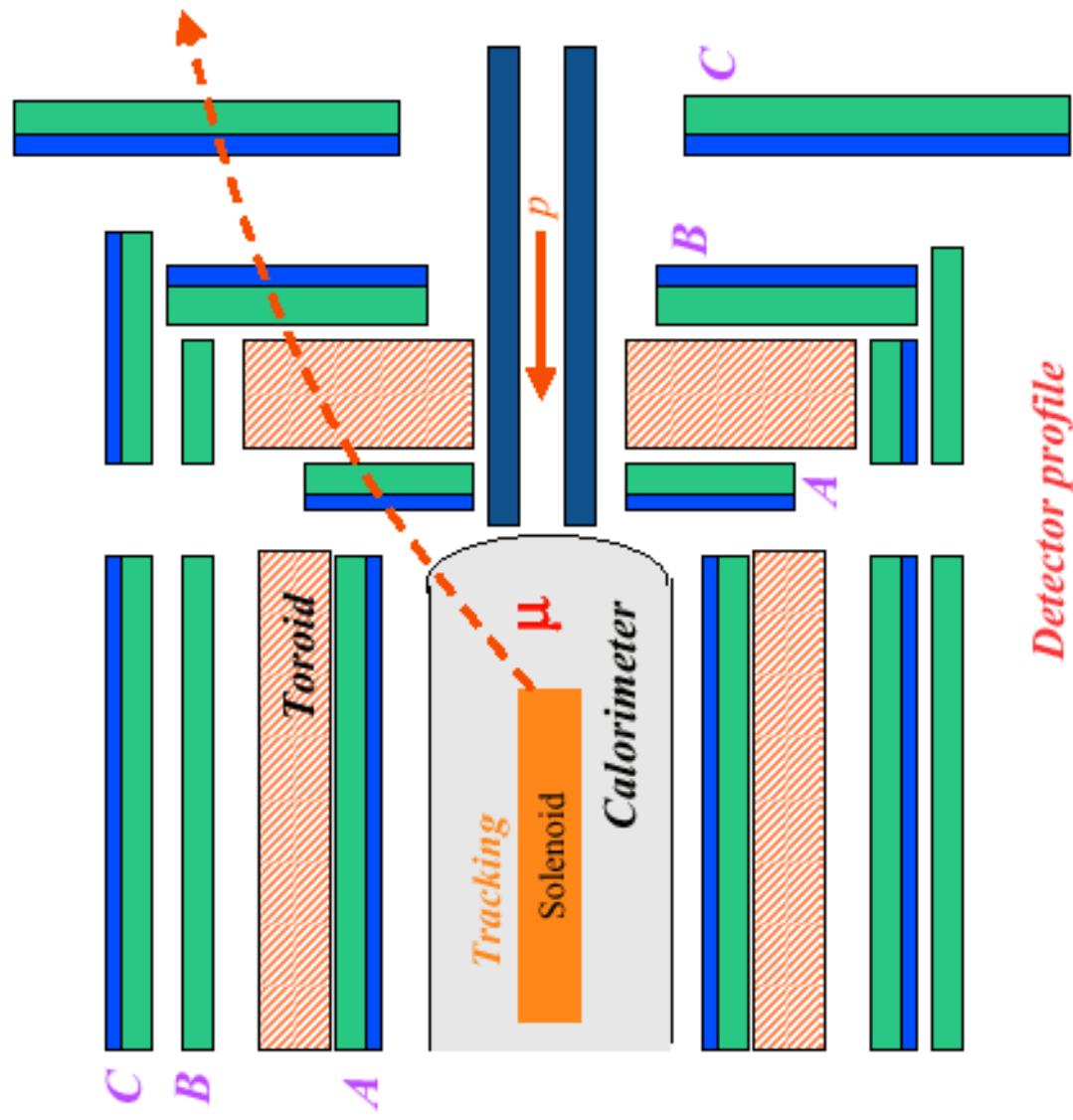


ITEP, Moscow, Russia

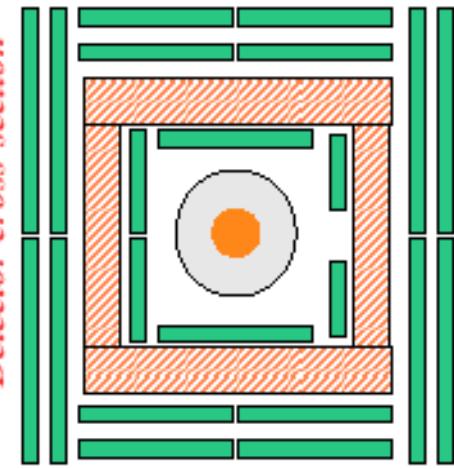


Northern Illinois University, De Kalb, USA

The D0 muon system

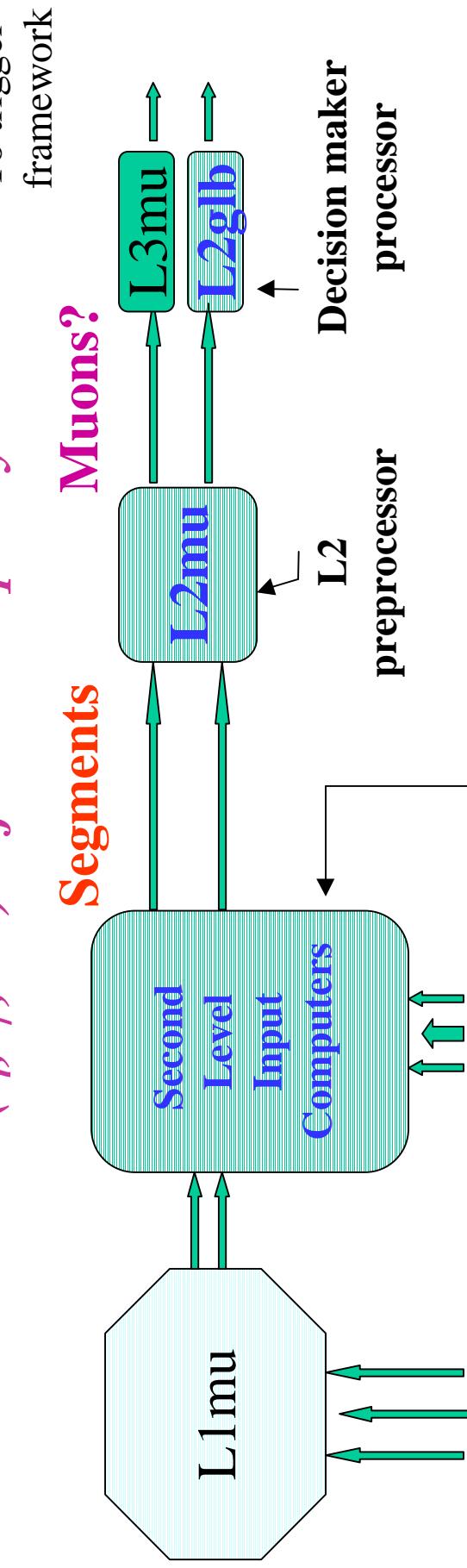


- Three muon layers: one inside (**A**), two outside (**B, C**) the toroid magnet (scintillators, drift tubes) scintillators
- The muon system is divided into central & forward regions; each region is subdivided into (8) octants



The DO L2 muon trigger

- * **L2MU:** Muon system event-wide online tracks reconstruction (η, ϕ, Pt) objects with quality



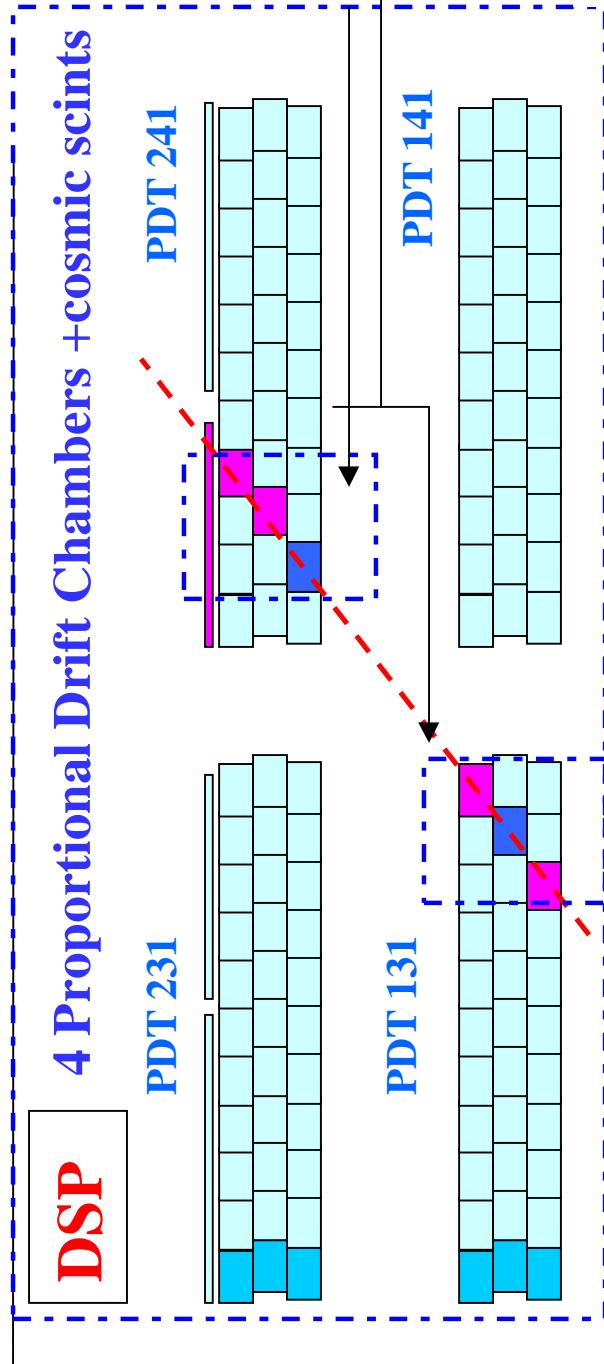
80 Digital Signal Processors (DSP) array responsible for Track-stub finding in small detector regions (with lookup tables) (Time budget $\sim 50 \mu\text{s}$)

Input
Proportional Drift Tubes
Mini-Drift Tubes,
Muon Scintillator Counters

- Rejection - tracking, Pt , time gate

Central stub-finding algorithms

Central DSPs
8 A-layer
32 BC-layer



- Scan separately PDT layers, form patterns

- Compare patterns with lookup tables
- Accept stub if N overlapped bits > 2
- Check associated scint. hit, assign quality

- Get η , r_z -slope, φ from tables
- Report segments to matching processor

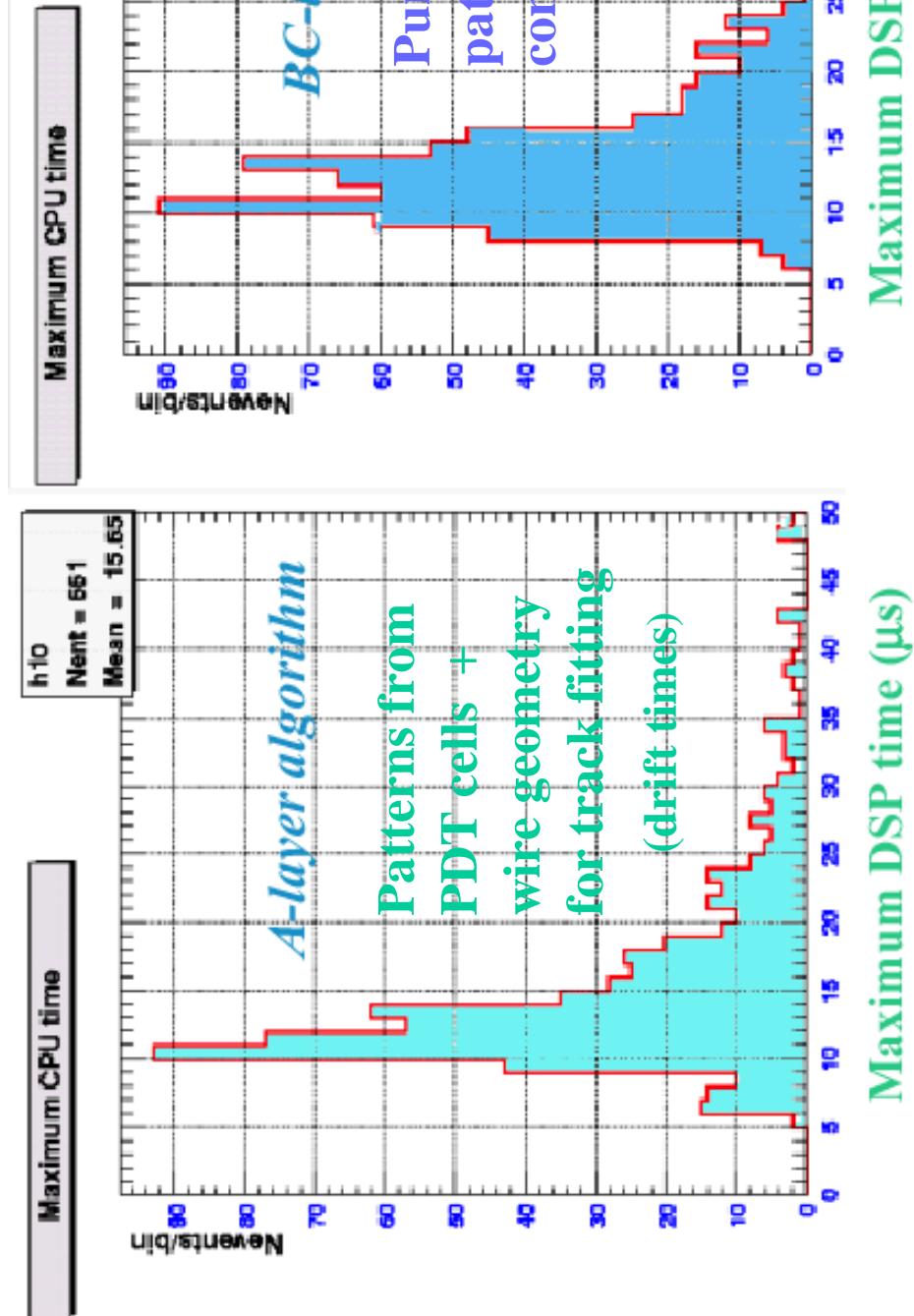
Set of 18-bit patterns for each [ci_b][ci_c] entry

Lookup table
(detector simulation)

Algorithms performance

- TIC compiler
- DSP evaluation board

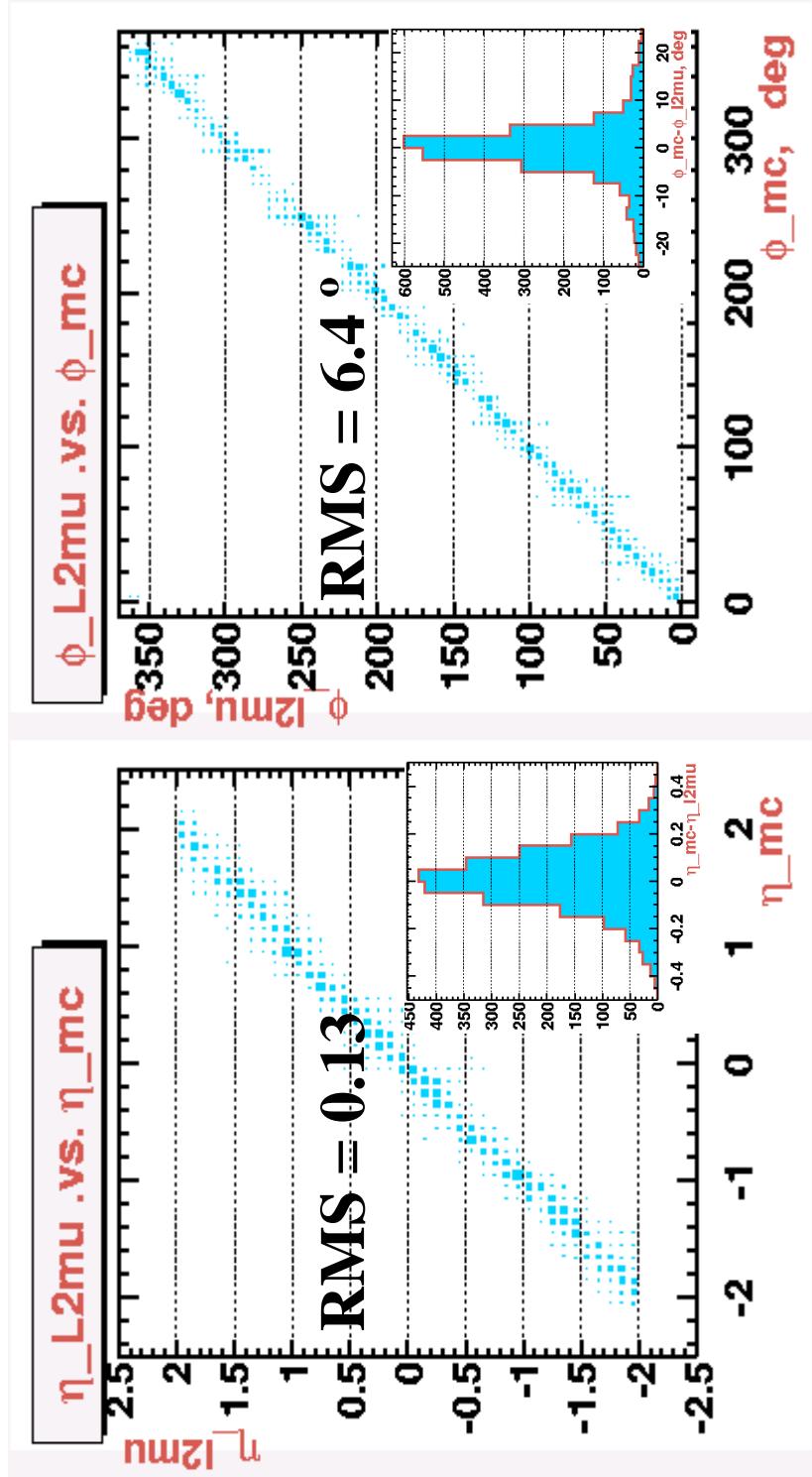
Time budget
 $\sim 50 \mu\text{s}$



MC verification

- L2mu muon track resolution -
GEANT3 D0 detector simulation

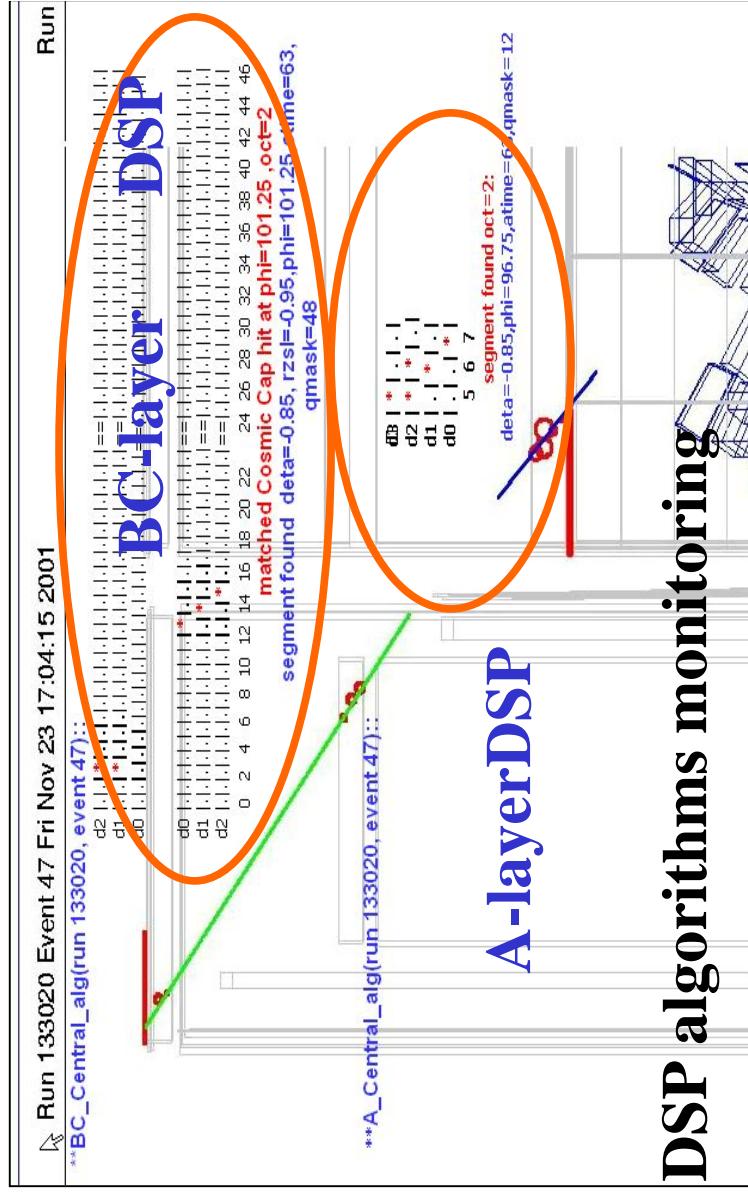
Plots for
single
muons
 $2 < P_t < 15$
GeV/c



$$\text{RMS}(1/P_t) = 0.39, \quad P_t_{\text{mc}} < 10 \text{ GeV}/c$$

Working with RunII data

- L2mu started online operating in **Nov. 2001**
 - First real data were analysed in December
 - All L2mu systems are in readout Jan 2002
 - Online .vs. Offline decision comparison-March
- **Ready to start rejection - April 2002**



Initial rejection and efficiency

Tim Christiansen, LMU,
Munich

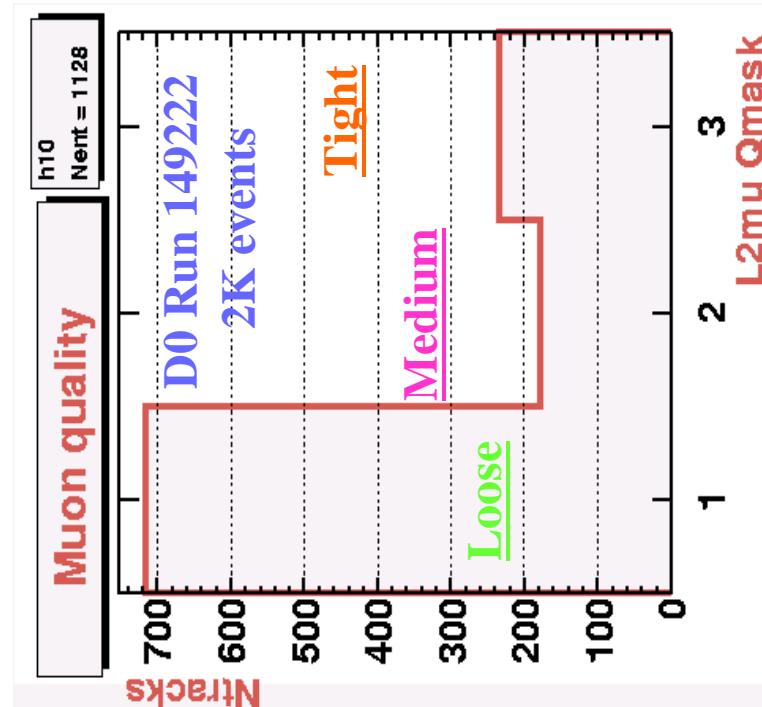
L2mu Quality definitions:

- Loose (no A - BC matching)
- Medium (at least matching)
- Tight (matching of the high quality stubs)

Efficiency $\approx \underline{98\%}$
(to D0 offline reconstruction)

Rejection $\approx \underline{1.7}$
to L1 single μ trigger

Suppress 40% of the
L1 events
still retaining
98% ‘official’ muons



Conclusion

- L2mu pattern recognition algorithms are stable and efficient
- muon L2 ready to start filtering by the end of April 2002
- higher rejection to come from Pt cuts

IMNO: Presented results had no chances to appear without Arthur Maciel, Christos Leonidopoulos, Tim Christiansen and all people working hard to keep L2mu alive